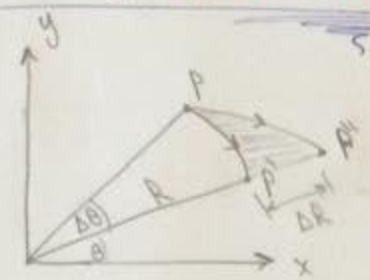
28/10/2015

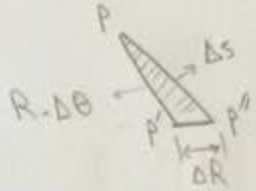
محاضرة 4 دكتور عماد كيلاني

AMR M.r

9

Velocity & Acceleration Analysis





$$\Delta s = R \cdot \Delta\theta + \Delta R$$

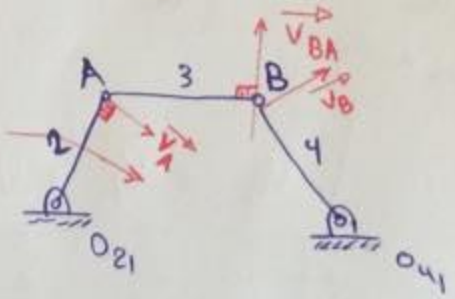
$$\frac{\Delta s}{\Delta t} = R \cdot \frac{\Delta\theta}{\Delta t} + \frac{\Delta R}{\Delta t}$$

$$\frac{ds}{dt} = R \cdot \frac{d\theta}{dt} + \frac{dR}{dt}$$

$\frac{ds}{dt} \rightarrow V$, $\frac{d\theta}{dt} \rightarrow \omega$

$$\vec{V} = R \cdot \vec{\omega} + \frac{dR}{dt}$$

Ex 2-1 Four bar mechanism



(rpm) n

(rad/s) ω_{21}

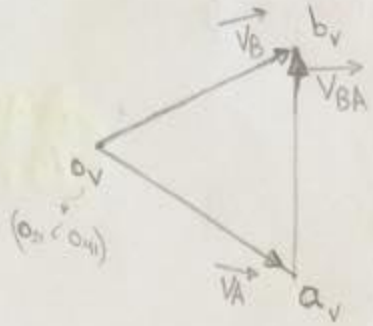
n (rpm) $\longrightarrow$ $\omega_{21} = \frac{2\pi n}{60}$ (rad/s $= s^{-1}$)

$\vec{V_A} = \omega_A \cdot O_{21}A$ (Mag.)

$\perp \overline{O_{21}A}$ (Dir.)

Free body (diagram)

- نختار مقياس رسم مناسب 1cm = ... m/s



$$\vec{V_B} = \vec{V_A} + \vec{V_{BA}}$$

(velocity Polygon)

c.c.w. a.c.w. anti clock wise counter clockwise

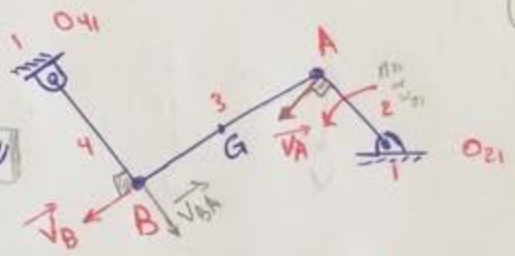
Ex 2-[2]

m_L = مقياس رسم الأطوال.

$O_{21}A = v$ $\quad O_{21}O_{41} = N$

$AB = v$

$B\,O_{41} = v$



$$\vec{V_A} = \omega_{21} * O_{21}A = N \quad \text{(Mag.)}$$

(Direc.) $\perp \overline{O_{21}A}$

A ← منطقة الـ A

ω_A الإتجاه

$$O_v a_v = \frac{\vec{V_A}}{O_{21}A}$$

scale of m_V = ...

1cm = ... m/s

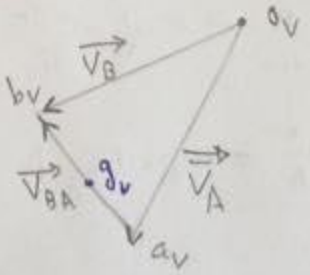
$$\frac{AB}{a_v b_v} = \frac{AG}{a_v g_v}$$

g_v يتم تحديد نقطة g_v عند الطريقة من على الرسم.

$$\vec{V_B} = \vec{V_A} + \vec{V_{BA}}$$

$$\vec{V_B} = O_v b_v * \text{scale} = N$$

$$\vec{V_{BA}} = b_v a_v * \text{scale} = N$$

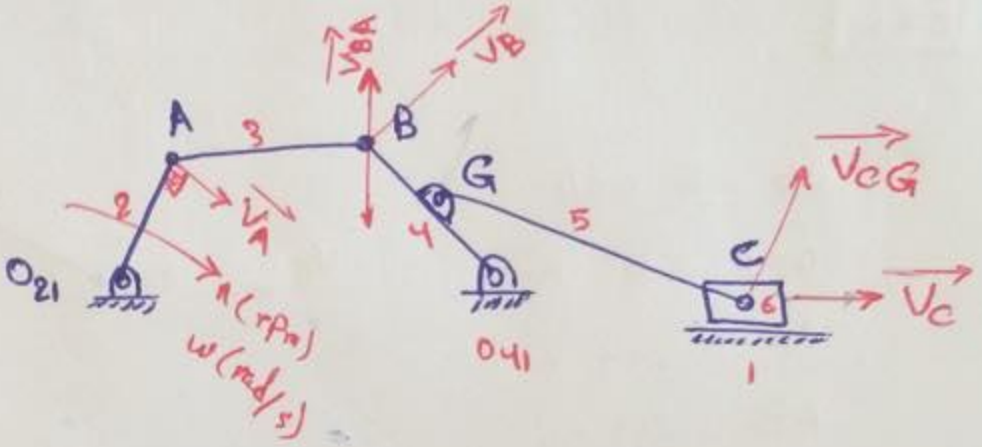


C

Ex : 3

إيجاد نقطة g_v على مضلع السرعات

$$\frac{bv\,gv}{BG} = \frac{bv\,ov}{BO_{41}}$$



velocity of A

$$\vec{V_A} = \omega_A * O_{21}A \quad (M)$$

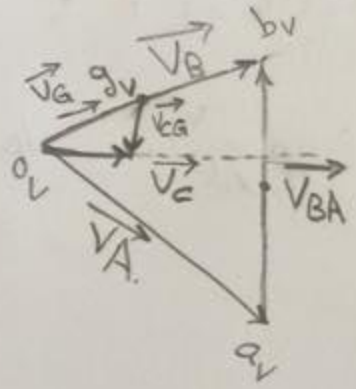
(D.)

$\perp O_{21}A)_A \quad \omega_A$

$\vec{V_B} \perp O_{41}B \quad \omega_{41}$

$\vec{V_{BA}} \perp AB)_B \quad \omega_{BA}$

scale $m_V \longrightarrow$ 1cm = ... cm/s



$$\vec{V_B} = \vec{V_A} + \vec{V_{BA}}$$

$$\vec{V_C} = \vec{V_G} + \vec{V_{CG}}$$

d

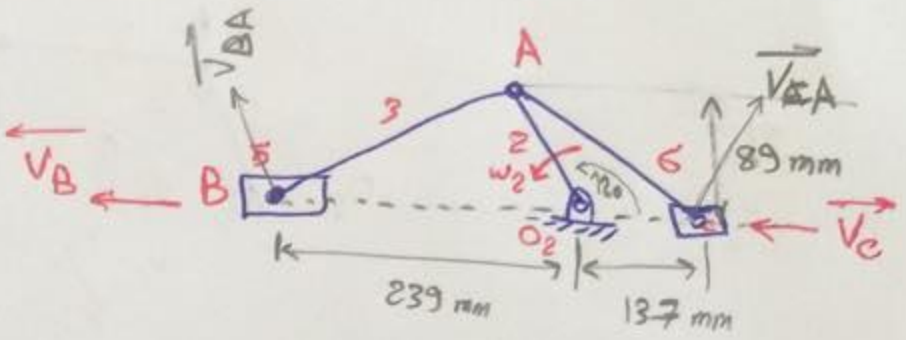
Ex2

$\omega_2 = 12$ rad/s

$O_2A = 102$ mm

$AC = 204$ mm

$AB = 204$ mm

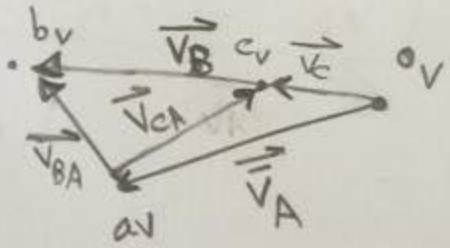


Req : $\vec{V}_B$, $\vec{V}_C$

scale : m_V 1cm = 400 mm/s

Sol

Velocity Polygon



Velocity of A : $\vec{V}_A$, (m/s)

$(AO_2)_A \perp$ (Dir) $\leftarrow V_A = \omega_2 * O_2A$ (M)

ω_2

$V_A = 12 * 102 = 1224$ mm/s

$V_A = 1,224$ m/s

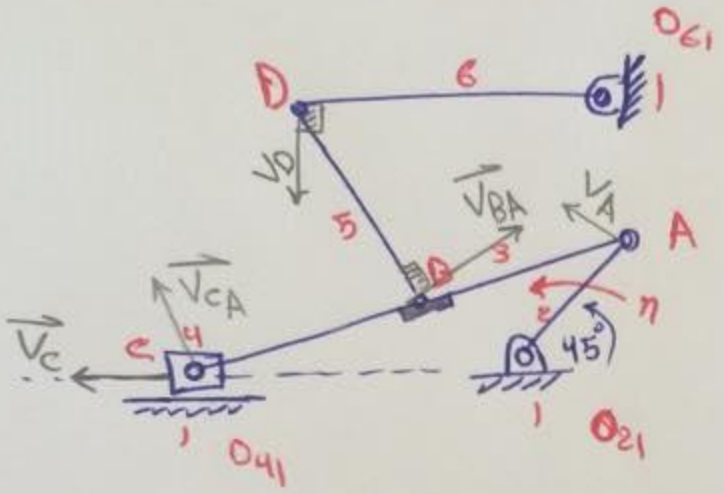
$\overline{V_B} = o_v b_v *$ scale = mm/s

$\overline{V_C} = o_v c_v *$ scale = mm/s

$\vec{V}_B$ // H.L , left Motion.

$\vec{V}_{BA}$

(e)



Sol:

Velocity Polygen

$\vec{V_A} = \omega_2 * O_2A =$ mm/s

$(\perp (D_1) \perp O_2A)_A, \omega_2)$

$\vec{V_C}$ = in H.L. into left side.

$\vec{V_{CA}} = \perp AC)_C$

Data:-

$\omega_2 = 8$ rad/s (cc.w)

$O_2A = 50,8$ mm

$O_6D = 102$ mm

$AB = 102$ mm

$AC = 203$ mm

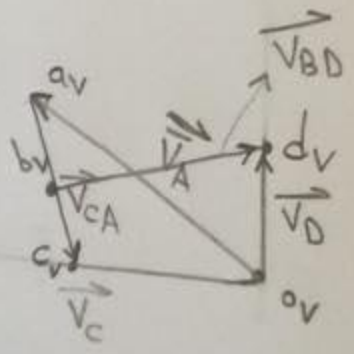
$BC = 102$ mm

req:-

$\vec{V_C}$ & $\vec{V_B}$

$\vec{V_{CD}}$ & $\vec{\omega_6}$

scale : mV : 1 cm = ... mm/s

$\frac{a_v b_v}{a_v c_v} = \frac{AB}{AC}$

$\vec{V_D} = \vec{V_B} + \vec{V_{DB}}$